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Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
Federal-State Joint Board On Universal Service	)	CC Docket No. 96-45

COMMENTS OF AT&T CORP.

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COMMENTS OF AT&T CORP.

Pursuant to the Commission's *Public Notice*,[1] AT&T Corp. ("AT&T") respectfully submits these comments opposing requests by the Rural Utilities Service ("RUS") and others that the Commission change its definition of "Voice Grade Access" for purposes of Federal Universal Service Support.

INTRODUCTION AND SUMMARY

To be eligible for universal service support, a telecommunications carrier must offer "voice grade access" ("VGA") to the public switched network.[2] In June of 1997, the Commission specified that VGA must cover a frequency range between 500 Hertz ("Hz") and 4000 Hz.[3] The Commission soon recognized, however, that this frequency range specification

[1] Public Notice, *Common Carrier Bureau Seeks Comment on Requests to Redefine "Voice Grade Access" For Purposes of Federal Universal Service Support*, CC Docket No. 96-45 (rel. Dec. 22, 1999) ("*Public Notice*").

[2] 47 C.F.R. § 54.101(a)(1) (1999).

[3] Report and Order, *Federal-State Joint Board On Universal Service*, C.C. Docket No. 96-45, 12 FCC Rcd. 8776, 8811, ¶ 64 (1997), *as corrected by Federal-State Joint Board on Universal Service*, Errata, CC Docket No. 96-45, FCC 97-157 (rel. June 4, 1997), *aff'd in part, rev'd in part, remanded in part sub. nom., Texas Office of Public Utility Counsel v. FCC*, 183 F.3d 393 (5th Cir. 1999), motion for stay granted in part, No. 97-60421 (Sept. 28, 1999), petitions for rehearing and rehearing en banc denied, No. 97-60421 (Sept. 28, 1999) ("*Universal Service Order*").

"would require eligible carriers to comply with a voice grade access standard that is more exacting than current industry standards."[4] The Commission then observed that because a 500 to 4000 Hz definition would be "more onerous . . . than [the frequency range] generally established under existing standards," it might "cause a substantial number of otherwise eligible carriers [to] be unable to qualify for universal service support."[5] Consequently, in December of 1997, the Commission adopted a VGA frequency range of 300 to 3000 Hz that it found to be more "consistent with Commission rules and . . . industry guidelines."[6] The Commission went on to state that it "may revisit this definition as voice grade standards evolve."[7]

Apparently in response to the Commission's statement that it may revisit its definition of VGA as such standards evolve, RUS and a few state commissions have complained that the Commission's choice of the industry standard VGA frequency range may not ensure that rural customers using 28.8 kbps modems to access the Internet can achieve data transmission speeds reasonably comparable to those achieved by non-rural customers using similar modems.[8] RUS

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[4] *Federal-State Joint Board On Universal Service; Access Charge Reform, Price Cap Performance Review for Local Exchange Carriers, Transport Rate Structure and Pricing, End User Common Line Charge*, 13 FCC Rcd. 5318 ¶ 16 (Dec. 30, 1997) ("*Fourth Order On Reconsideration*").

[5] *Id.*

[6] *Id.*

[7] *Id.*, n. 38.

[8] *See* Petition for Reconsideration of the North Dakota Public Service Commission at 1-2 ("NDPSA Petition"), Petition for Reconsideration of the South Dakota Public Utilities Commission at 1-2 ("SDPUC Petition"), and Petition for Reconsideration of the Washington Utilities Commission at 1-2 ("WUC Petition"), CC Docket Nos. 96-45, 86-262, 94-1, 91-213, 95-72 (Feb. 12, 1998); *Ex Parte* Presentation of the Rural Utilities Service at 4 (Jan. 27, 1998) ("RUS *Ex Parte*").

and its supporters urge the Commission to expand the VGA frequency range to require 300 to 3500 Hz.

This request should be denied. Although AT&T agrees that rural and urban customers should have reasonably comparable access to the Internet, changing the VGA specifications for universal service is not an appropriate means for achieving that goal.

The principal purpose of universal service support financed by assessments on interstate telecommunications revenues is to ensure that all households have a reasonable opportunity to make and receive voice telephone calls (such as to E911) and that their access to advanced services is not impeded.[9] Because of the engineering and input value specifications adopted by the Commission for its forward-looking mechanism for high cost support, non-rural carriers receive support adequate to provide voice service and to allow analog data transmission speeds that far exceed 28.8 kbps in throughput for both their rural and urban customers. And mechanisms providing support to rural carriers also do not limit or discriminate in allowed network quality. Thus, to the extent that the embedded networks of rural and non-rural carriers do not provide appropriate capabilities for voice or data transport, it is not due to lack of universal service support.

And, even if, *arguendo,* some rural customers are not receiving adequately fast data services on their telephone lines, RUS' proposal that the appropriate solution would be for the Commission to prescribe an expanded VGA is misguided. There are several reasons.

First, as the Public Notice confirms – and as RUS has conceded – there are no industry standards or specifications for deploying a telecommunications network with performance that

[9] *See* 47 U.S.C. 254(b)(3) (1999).

guarantees a minimum VGA bandwidth of 3200 Hz.[10] Nor is there any industry agreement that a change in this network performance parameter, without complementary changes to minimum levels of other network performance parameters, will achieve the dual goals of quality voice services and appropriate access to advanced services. Without an agreed upon suite of parameter specifications, each implementing carrier might employ inconsistent (or ineffectual) network modifications to achieve the newly desired VGA frequency range. The result of such patchwork measures could be reduced reliability and interoperability of the public switched telephone network.

Second, even if a consensus could be reached on a suite of new network specifications that would guarantee this expanded VGA frequency range, the costs associated with implementing the new specifications would be enormous. At a very minimum, the modification could require the change-out of the codecs contained within each line card or line unit of every digital switch or digital loop carrier system currently installed in the United States,[11] resulting in the very costly and potentially unintended consequence of diverting limited capital investment funds from initiatives that promise much greater payoffs to all consumers (including those in rural areas) than the RUS analog bandwidth expansion proposal.

Third, it is far from clear that requiring expansion of the minimum VGA frequency range as proposed by RUS would further its stated goal of significantly improving analog modem performance. RUS and its supporters have offered no *evidence* that an expanded frequency range would generally improve existing modem speeds on modern loops (and certainly have not

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[10] *See Public Notice* at 2; *Fourth Order On Reconsideration* ¶ 16; RUS *Ex Parte* at 5.

[11] These codecs filter incoming analog waveforms to pass only a particular bandwidth. The codec then samples this limited waveform every 8000th of a second to digitize it.

shown that the proposed change is cost-justified as compared to alternatives for reaching this objective). Indeed, as detailed below, expansions of VGA's minimum frequency range could actually *degrade* modem performance.

Finally, to the extent there is a real concern with improving data transmission speeds, it would be foolhardy to require carriers to expend substantial sums to achieve the extremely modest maximum improvement of about 20% in modem speeds that a 500 Hz bandwidth expansion could, at most, offer.[12] Instead, the Commission should encourage rural carriers to: (1) remove bridge taps and load coils and take other steps to meet the engineering specifications upon which forward-looking universal service funding is calculated, and (2) deploy modern digital technologies such as xDSL or digital HFC networks that have the ability to offer both rural and urban customers the 50 to 100 fold improvements in data transfer rates that they imminently seek. Not only would such upgrades far better address customer demands, but they could be implemented more readily and at less cost than proposals to boost analog bandwidth by 500 Hz.

ARGUMENT

I. THE COMMISSION'S UNIVERSAL SERVICE SUPPORT MECHANISMS ALREADY PROVIDE FOR APPROPRIATE LEVELS OF VOICE AND DATA ACCESS.

The principal purpose of universal service support financed by assessments on interstate telecommunications revenues is to ensure that all households have a reasonable opportunity to make and receive voice telephone calls (such as to E911) and that their access to advanced

[12] *See Ex Parte* Letter from Richard N. Clarke, AT&T to William F. Caton, Secretary, FCC, CC Docket Nos. 96-45 and 96-262 (filed April 29, 1997) (*AT&T Ex Parte*).

services is not impeded.[13] While never formally codified, "access to advanced services" has been taken to mean a capability to receive data throughput rates commonly achieved by mass-market modems. Currently accepted mass-market modem capacities are in the 28.8 to 56 kbps range.

The analog transmission of data across loops depends significantly on the electrical performance of the loop in terms of, among other things, its signal to noise ratio, its frequency and phase response curves (which define its bandwidth), and various impairments resulting from crosstalk or reflections caused by bridge taps.[14] In turn, these electrical characteristics are strongly influenced by physical characteristics of the "loop" such as its length, its gauge of wire, its number and quality of splices, its degree of twist and insulating materials, its temperature, and the number of switches and digital loop carrier terminals the circuit passes through. Because all "loops" differ from one another with respect to these characteristics, modern analog modems are designed to "probe" the electrical characteristics of each dialed-up circuit at the beginning of each connection to determine the optimal data transmission speed that can be supported on that particular connection.[15] As a result, both urban and rural customers commonly see circuits that

[13] *See* 47 U.S.C. 254(b)(3) (1999).

[14] As used in this context, the term "loop" is meant to incorporate not just the transmission facility connecting a customer premises with an end office, but also the switches at the end office, and other interoffice transmission or tandem switching facilities that may be traversed in completing a dial-up connection.

[15] *See* G. David Forney, Jr., Les Brown, M. Vedat Eyubolgu, and John L. Moran, III, Motorola Inc., "The V.34 High-Speed Modem Standard," *IEEE Communications Magazine* at 28-33 (Dec. 1996). Note that the optimal speed is not necessarily the absolute fastest speed that the circuit can support. Because modems check for data transmission errors and correct them through packet resends, typically a modem will choose a transmission speed slower than the absolute maximum because it results in superior throughput by reducing the need for packet resends.

vary in connect speeds between 20 and 50 kbps.[16] When the analog copper portions of loop networks are designed without load coils and bridge taps, using good quality 24 or 26 gauge cable, and are limited to less than 18,000 feet in length, modem connections should easily exceed 28.8 kbps in data throughput. Moreover, under such circumstances, it is extremely unlikely that the copper cable portion of the loop would be the limiting factor in determining the maximum data throughput on the loop.[17]

The engineering and input value specifications adopted by the Commission for its forward-looking mechanism for high-cost support are sufficiently conservative (*e.g.*, maximum 12,000 foot length of 26 gauge copper wire, maximum 18,000 foot length of 24 gauge copper wire, no bridge taps or load coils, modern digital end office and tandem switches, etc.) to provide all customers with voice service and analog data services that far exceed 28.8 kbps in throughput, regardless of geographic location. Thus, RUS' proposal to expand the definition of VGA is immaterial in this regard because the Commission's non-rural universal service program supports service quality in excess of what RUS requests to be enabled.

AT&T recognizes that some carriers, both rural and non-rural, do not provide appropriate capabilities for voice or data transport due to their past decisions not to upgrade their networks to modern standards. To the extent that carriers have copper loops in excess of 18,000 feet (and these exist in both rural and non-rural areas), to the extent that these loops have load coils, to the extent that loop splices are frequent and of poor quality, to the extent that carriers use universal

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[16] *See AT&T Ex Parte.*

[17] It is more likely that codec filtering or the interoffice transmission path will be the "weak link." *Id.*

and not integrated digital loop carrier systems and use tandem switching rather than direct trunking, data throughput performance suffers.

These decisions, however, are not due to any deficiencies in universal service support. Current support mechanisms allow the recovery of costs adequate to provide comparable and appropriate levels of VGA to both rural and non-rural customers.[18] Thus, the appropriate "solution," if any, to the "problem" identified by RUS is for carriers whose networks currently employ inefficient or antiquated design elements to take steps to ameliorate those deficiencies, not to expand the definition of VGA bandwidth.

II. THE RUS PROPOSAL IGNORES THE ADVERSE CONSEQUENCES OF A VGA FREQUENCY RANGE THAT IS NOT SUPPORTED BY INDUSTRY TECHNICAL STANDARDS.

RUS admits that there are currently no industry standards or specifications for building a telephone network that guarantees a VGA bandwidth of 3200 Hz on every loop.[19] Absent such standards or specifications, attempts to enhance the bandwidth parameter of electrical performance may have untoward effects on other aspects of telephone service. Indeed, without the benefits of a complete set of industry specifications for increasing VGA frequency range, carriers would have no technical guidance regarding the best method for upgrading their

[18] In the past, the Commission has not conditioned the receipt of universal service support funds on a carrier's adherence to a particular network performance standard. AT&T believes that because universal service support plans are calibrated and funded to "buy" particular levels of network performance, if the Commission imposes such standards, any carrier whose network does not meet those performance standards should be ineligible to receive federal support.

[19] *See id.; See also Public* Notice at 2; *Fourth Order On Reconsideration* ¶ 16; RUS *Ex Parte* at 5. Current industry specifications assume a frequency range for VGA of 300 Hz to 3000 Hz. *See Fourth Order On Reconsideration* ¶ 16 (citing AT&T, *Engineering and Operations in the Bell System* 194-195 (Second Edition); Bellcore, *Principles of Bellcore's Telecommunications Transmission Engineering* 666, 680-681 (Third Edition); American National Standards Institute, Interface Between Carriers and Customer Installations – Analog Voicegrade Switched Access Lines With Distinctive Alerting Features 4 (1994)).

telecommunications networks to provide expanded VGA frequency ranges. Instead, each carrier would have to implement its own untested changes that might be ineffective or even detrimental to the interoperability and reliability of telecommunications networks.[20] The Commission should reject the RUS proposal for this reason alone.

Moreover, even if an industry agreement could be reached on a set of new network specifications that would guarantee an expanded VGA frequency range, deployment of such a network consistent with these standards would be very costly. Although the exact costs of increasing the VGA frequency range cannot be estimated with any precision until revised industry specifications have identified exactly what network changes would be needed to implement this expansion – the costs of these network changes could easily exceed tens of billions of dollars. For example, a necessary component of increased VGA bandwidth could be the enhancement of switch and digital loop carrier codec performance to digitize higher bandwidths. This enhancement would require the replacement of the line cards and line units serving over 170 million lines with cards and/or units that incorporate more advanced codecs. Even if the installed cost of this upgrade were as low as $60 per line, the total cost could exceed $10 billion.

Requiring carriers to undertake such massive expenditures to upgrade the analog bandwidth of a loop by a few hundred Hz would be nonsensical. First, because all portions of synchronous digital circuit-switched voice networks in the United States (and the world) expect circuits to be built up out of individual 64 kbps channels that are built up from 8-bit encoding of

[20] For example, one way to expand the measured frequency range of a loop connection is to add high frequency gain to the loop signal. This could cause voice over such telephone lines to become unintelligible by persons using assistive devices such as hearing aids, and may degrade (Continued...)

8000 times a second sampled analog waveforms, analog bandwidth cannot be expanded beyond 4000 Hz without a complete changeout of nearly every piece of electronic circuit equipment in the network. Thus, once customers demand data throughput exceeding 56 kbps, any billions spent to expand the VGA bandwidth would be without continuing value. Second, any project to change-out just line cards and units of all switches and digital loop carriers could occupy existing switch manufacturing and installation capacity for years. In the interim, there would be no resources available to add new features to switches, install new service or extend services to previously unserved areas, or to provide repair for existing lines. Indeed, rural customers would, most likely, benefit more from these alternative uses of switch investment and labor than a multiple year effort to provide, at maximum, a 20% increment to analog bandwidth.

III. IT IS UNLIKELY THAT A FEASIBLE EXPANSION IN VGA BANDWIDTH WOULD APPRECIABLY IMPROVE ANALOG MODEM THROUGHPUTS.

Even if the technical and financial obstacles associated with increasing the VGA bandwidth could be ignored, RUS has failed to demonstrate that its proposal would serve its stated goal of improving analog modem performance. As RUS has conceded, the suggested increase in VGA bandwidth "will not guarantee that a modem will connect at 28.8 kbps" because "restricted bandwidth is not the only impediment to modem performance." RUS *Ex Parte* at 4. As discussed above, there are many other factors affecting the speed at which modems communicate, including, but not limited to, the amount of noise on the loop, the existence of crosstalk, singing or echoes in the loop, and the loudness of signals transmitted over the loop.

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data throughput by causing more modem connections to inadvertently disconnect or cause reduced efficiency of modems located close to the central office.

Significantly, simply increasing VGA bandwidth may actually *decrease* the maximum speeds at which today's modems communicate. For example, high frequency signals carried on wire pairs attenuate faster than low frequency signals. Modern modems expect this, and provide equalization to ensure that the maximum amount of data is correctly transmitted. But if carriers expand the bandwidth of their loops by boosting the loudness of high-frequency signals, two problems arise. First, portions of this increased loudness would spill over and cause distortion in the lower frequencies, a factor that could *degrade* modem performance. Second, because current modems expect to add their own gain to high frequency signals, they would have to be redesigned so as not to duplicate the gain that would now be added by carriers.

RUS does not even address these offsetting factors, much less demonstrate that increasing the VGA frequency range would have a net positive impact on modem performance after all relevant effects are considered.

IV. THE BEST WAY TO IMPROVE DATA TRANSMISSION SPEEDS IS TO ENCOURAGE DEPLOYMENT OF MODERN DIGITAL TECHNOLOGIES.

RUS admits that any potential benefits from forcing carriers to invest in modestly improved narrowband analog technology would not be realized for several years, the distant future in Internet time. Indeed, RUS favors at least a three-year phase-in period before rural carriers have to comply with their proposed VGA frequency range increase.[21] Thus, the issue here is whether carriers should be forced to spend massive funds in hopes of achieving marginal

[21] Even RUS admits that, several years will pass before rural carriers could fully upgrade their networks. *See* RUS *Ex Parte* at 3-4 (recommending a phase in period for increasing bandwidth because it would take carriers time to upgrade their networks); SDPUC Petition at 2 (recommending a phase in period of three years); NDPSC Petition at 2 (recommending a phase in of a "period of years"); WUTC Petition at 3 (same).

future improvements to analog modem speeds, or whether they should be encouraged to invest these funds in modern digital broadband technologies such as xDSL or HFC networks that have the capacity to improve access to the Internet by 50 to 100 fold.

As the Commission has noted on several occasions, the future of Internet access is through broadband technology.[22] The Commission has adopted a policy of encouraging all carriers to invest in broadband technology in order to more quickly bring that technology to all residential consumers.[23] The RUS proposal – which would inefficiently devote scarce resources to a dead-end methodology to marginally increase modem speeds – is inconsistent with this policy. Not only would alternative digital upgrades far better address current and imminent customer demands, but they could be implemented more quickly and at far less cost per kbps than RUS' proposals to expand analog bandwidth.

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[22] *See e.g.* Remarks by FCC Chairman William E. Kennard Before the Federal Communications Bar, Northern California Chapter, San Francisco, CA, *The Unregulation of the Internet: Laying a Competitive Course for the Future* at 3 (July 20, 1999) (noting that "[b]roadband is the future of the Internet.") ("FCC Chairman's Comments in California") <http://www.fcc.gov/speeches/kennard/spwek924.html>; Remarks by William E. Kennard at the National Ass'n of Telecommunications Officers and Advisors 19th Annual Convergence, *Consumer Choice Through Competition* at 3-6 (Sept. 17, 1999) (noting that [t]he most important issue on our agenda today is broadband" and the FCC wants "four things . . . fast deployment. . . ubiquitous deployment. . . competitive deployment. . . [and] open deployment.") ("FCC Chairman's Telecommunications Remarks") <http://www.fcc.gove/speeches/Kennard/spwek931.html.>

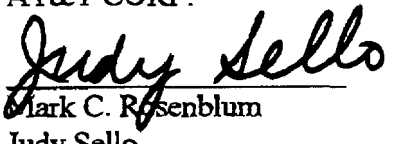
[23] *See* FCC Chairman's California Remarks at 3; FCC Chairman's Telecommunications Remarks at 3-6. A recent study by the Commission confirms that carriers are working towards providing all customers with broadband technology. The Commission found that during the next five years, the percentage of individuals subscribing to dial-up services relative to broadband services will fall significantly, that cable facilities based high-speed "Internet access deployment . . . has extended to rural and small communities," and that local exchange carriers "have adopted aggressive deployment schedules for DSL." *See* Broadband Today at 23.

CONCLUSION

For the foregoing reasons, the Commission should not revise its VGA definition for universal service to include frequency ranges wider than 300 to 3000 Hz.

Respectfully submitted,

AT&T CORP.



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January 19, 2000

CERTIFICATE OF SERVICE

I, Peter M. Andros, do hereby certify that on this 19th day of January, 2000, a copy of the foregoing Comments of AT&T Corp. was served via U.S. first class mail, postage prepaid, to the parties listed on the attached Service List.

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